

A2 CC1 Properties of Exponents

Name of Rule	Algebraic Rule	Rule In Words	Example
Product Rule	$a^m \cdot a^n = a^{m+n}$	When multiplying with exponential notation, if the bases are the same, keep the base and add the exponents.	$5^6 \cdot 5^3 = 5^{6+3} = 5^9$ $4^5 \cdot 4^{-2} = 4^{5+(-2)} = 4^3$
Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$	When dividing with exponential notation, if the bases are the same, keep the base and subtract the exponent of the denominator from the exponent of the numerator.	$\frac{m^5}{m^{-4}} = m^{5-(-4)} = m^{5+4} = m^9$
Power Rule	$(a^m)^n = a^{mn}$	To raise a power to a power, multiply the exponents.	$(y^{-3})^{-7} = y^{(-3)(-7)} = y^{21}$
Raising a Product to a Power	$(ab)^n = a^n b^n$	To raise a product to the n th power, raise each factor to the n th power.	$(3x^3 y^4)^2$ means $(3^1 x^3 y^4)^2$ $= 3^2 (x^3)^2 (y^4)^2$ $= 9x^6 y^8$
Raising a Quotient to a Power	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	To raise a quotient to the n th power, raise both the numerator and the denominator to the n th power.	$\left(\frac{-3}{b^5}\right)^3 = \frac{(-3)^3}{(b^5)^3} = \frac{-27}{b^{15}}$
Exponent of 1	$a^1 = a$	Any number raised to the first power yields the original number.	$x^1 = x, 7^1 = 7$
Exponent of 0 (zero)	$a^0 = 1, a \neq 0$	Any non-zero number raised to the zero power yields 1. 0^0 is undefined.	$(5x)^0 = 1, 397^0 = 1$
Negative Integers as Exponents	$a^{-n} = \frac{1}{a^n}$	Any number raised to a negative exponent is the same as the reciprocal of that number raised to the opposite exponent.	$5x^{-3} = \frac{5}{x^3}, \frac{1}{n^{-7}} = n^7$

EXPONENTS PRACTICE

Simplify:

1. $3 \cdot 4^3$

2. $4x^3 \cdot 2x^3$

3. $x^5 \cdot x^3$

4. $2x^3 \cdot 2x^2$

5. $\frac{6^5}{6^3}$

6. $\frac{x^4}{x^7}$

7. 8^0

8. $-(9x)^0$

9. $(y^4)^3$

10. $(x^2y)^4$

11. $\frac{6x^7}{2x^4}$

12. $\frac{8x^5}{4x^2}$

13. $(2cd^4)^2(cd)^5$

14. $(2fg^4)^4(fg)^6$

15. $\frac{x^5y^6}{xy^2}$

16. $\frac{x^2y^5}{xy^4}$

17. $\left(\frac{4x^5y}{16xy^4}\right)^3$

18. $\left(\frac{5x^3y}{20xy^5}\right)^4$

19. y^{-7}

20. 7^{-2}

21. $\frac{1}{x^{-5}}$

22. $\frac{1}{2^{-4}}$

23. $x^5 \cdot x^{-1}$

24. x^{-6}

25. $x^9 \cdot x^{-7}$

26. $(j^{-13})(j^4)(j^6)$

27. $\frac{x^{-1}}{x^{-8}}$

28. $\frac{52x^6}{13x^{-7}}$

29. $f^{-3}(f^2)(f^{-3})$

30. $\frac{x^{-4}}{x^{-9}}$

31. $\frac{24x^6}{12x^{-8}}$

32. $\frac{3x^2y^{-3}}{12x^6y^3}$

33. $(2x^3y^{-3})^{-2}$

34. $\frac{2x^4y^{-4}}{8x^7y^3}$

35. $(4x^4y^{-4})^3$

36. $5x^2y(2x^4y^{-3})$

37. $\left(\frac{-7a^2b^3c^0}{3a^3b^4c^3}\right)^{-4}$

38. $\left(\frac{-2a^3b^2c^0}{3a^2b^3c^7}\right)^{-2}$